

# Incisors' proportions in smile esthetics

Fahad F Alsulaimani and Waeil Batwa

## ABSTRACT

**Aims:** To determine whether alteration of the maxillary central and lateral incisors' length and width, respectively, would affect perceived smile esthetics and to validate the most esthetic length and width, respectively, for the central and lateral incisors.

**Materials and Methods:** Photographic manipulation was undertaken to produce two sets of photographs, each set of four photographs showing the altered width of the lateral incisor and length of the central length. The eight produced photographs were assessed by laypeople, dentists and orthodontists.

**Results:** Alteration in the incisors' proportion affected the relative smile attractiveness for laypeople ( $n=124$ ), dentists ( $n=115$ ) and orthodontists ( $n=68$ ); dentists and orthodontists did not accept lateral width reduction of more than 0.5 mm ( $P<0.01$ ), which suggests that the lateral to central incisor width ratio ranges from 54% to 62%. However, laypeople did not accept lateral width reduction of more than 1 mm ( $P<0.01$ ), widening the range to be from 48% to 62%. All groups had zero tolerance for changes in central crown length ( $P<0.01$ ).

**Conclusion:** All participants recognized that the central incisors' length changes. For lateral incisors, laypeople were more tolerant than dentists and orthodontists. This suggests that changing incisors' proportions affects the relative smile attractiveness.

**Key words:** Attractiveness, esthetics, incisors, smile

## INTRODUCTION

In recent years, esthetic dentistry has become a major focus for the public. This trend was initiated by Prosthodontists and, recently, by orthodontists. It can be said that the smile is the sum of a number of features that contribute to it, either positively or negatively.<sup>[1]</sup> These features comprise the lips, soft tissue (gingiva) and hard tissue (teeth). Although measuring the smile as a whole is difficult, breaking it into small components makes it amenable to measure and study. All these components lie within the display zone of the smile and are proportionally related to each other.<sup>[2]</sup>

From the lateral incisor perspective, various widths were suggested. Although Lombardi suggested that, ideally, the width of the lateral incisor should be 62% of the width of the maxillary central incisor (Golden proportion),<sup>[3]</sup> Snow recommended an only 60% lateral to incisor width ratio (the golden percentage). Furthermore, Snow suggested that the width of each tooth to the total width of the anterior teeth (canine to canine) should be as follows: Canine 10%, lateral incisor 15% and central

incisor 25%.<sup>[4]</sup> Ward, on the other hand, used the recurring esthetic dental (RED) proportion and advised that successive tooth widths should remain constant, starting from the midline and progressing distally, and that a 70% lateral to incisor width proportion would give better esthetic results than 62% when the width/height ratio of the central incisors is about 0.75-0.78.<sup>[5]</sup> For the central incisor, the tooth width is expected to be proportioned to its length, where it is expected to be 0.8:1 for an average long incisor (10.4-11.2 mm).<sup>[6]</sup> However, none of the previously mentioned approaches were conclusive regarding the most esthetic width of the lateral incisor.

In this paper, the importance of maxillary incisors' proportions will be investigated to determine the most esthetic width of the maxillary lateral incisor (relative to central incisor) in addition to the most esthetic length of the central incisors.

The specific aims of this study were to determine: (1) whether alteration of the maxillary lateral incisor crown width (its

Department of Preventive Dental Science, Orthodontic Division, King Abdulaziz University, Jeddah, Saudi Arabia

**Address for correspondence:** Dr. Waeil Batwa, Department of Preventive Dental Science, Orthodontic Division, King Abdulaziz University, P. O. Box - 80209, Jeddah - 21589, Saudi Arabia. E-mail: wbatwa@gmail.com

### Access this article online

Quick Response Code:



Website:

www.jorthodsci.org

DOI:

10.4103/2278-0203.119685

proportion to central) would affect the perceived smile esthetics, (2) whether alteration of the maxillary central incisor crown width to length ratio would affect the perceived smile esthetics, (3) the most esthetic maxillary lateral to central incisor width ratio and (4) the perception of laypeople, dentists and orthodontists to the altered ratios.

## MATERIALS AND METHODS

Using photographic manipulation, a computerized prediction of the appearance of the smile was undertaken. Then, laypeople, dentists and orthodontists assessed the developed photographs.

A smile photograph of an individual with an attractive smile was acquired using a still digital camera (Canon EOS 40D digital camera - 10 megapixels, Cannon incorporation, Tokyo, Japan). The image was manipulated using Adobe Photoshop Elements software (version 6.0., Adobe, San Jose, California, United States). The image was obtained by capturing a photograph of the lower third of the face. After that, the image scale was adjusted to counter any magnification by reproducing the same clinical incisor length on the photographs using the Photoshop software. Two features were altered and eight photographs were produced. The manipulated features were: Maxillary lateral incisors crown width and maxillary central incisors crown length. The developed photographs represent two sets, each a set of four photographs [Figures 1 and 2]. The life-size photographs were coded to enable photograph recognition and, later, analysis.

For the maxillary lateral incisors', crown width was reduced in increments. As the lateral width was reduced, the incisor width increased in order to compensate for the created space. The four developed photographs were: Average crown width (A2); 0.5 mm reduced width (B2); 1.0 mm reduced width (C2) and 1.5 mm reduced width (D2).

For the maxillary central incisor, the crown length was shortened in increments by reducing the crown from the incisal edge. Four photographs were developed as follows: Average crown length to width ratio of 0.8:1 (A1), 1.0 mm reduced crown length (B1), 1.5 mm reduced crown length (C1) and 2.0 mm reduced crown length (D1).

A total of 307 participants were recruited (115 dentists, 68 orthodontists and 124 laypeople). After a brief explanation, the participants were asked to rate each image. The photographs were shuffled and presented individually. Participants were allowed to view each photograph for as long as they found necessary. The participants used a numeric rating scale, where score 0 is the least esthetic while score 5 is the most esthetic.

## Statistical Methods

### Analytical statistics

Descriptive and analytical statistics were used to show the

differences in the smile ratings; repeated measures ANOVA tests were used to determine if there is a difference between the photographs' ratings. In order to reduce the chance of error (type-I error) in hypothesis testing, a significance level of 0.01 was adopted.

## RESULTS

78.2% of the laypeople, 60% of the dentists and 35.3% of the orthodontists were female. Figures 3 and 4 show the means of smile rating of changes in lateral incisor width and central incisor length for each group. The average smiles in each

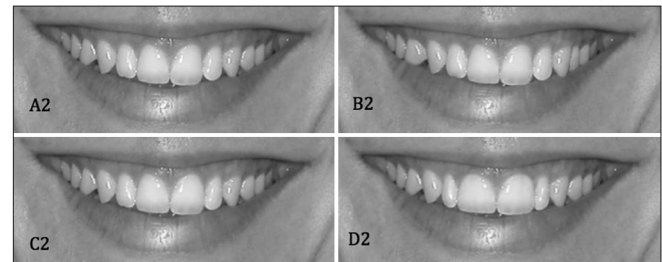


Figure 1: Changes in maxillary lateral incisor crown width

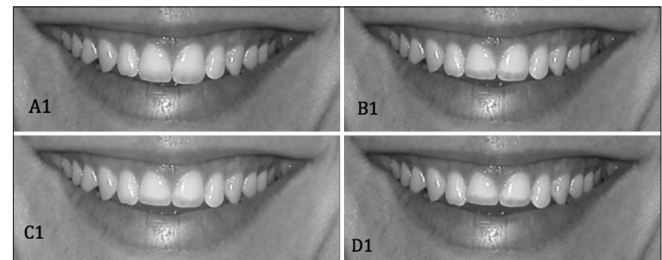


Figure 2: Changes in maxillary central incisor crown length

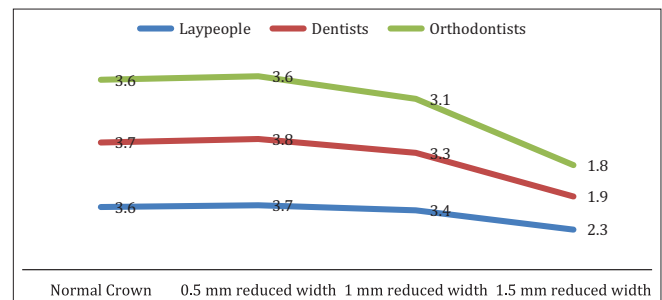


Figure 3: Mean smile rating of changes in lateral crown width

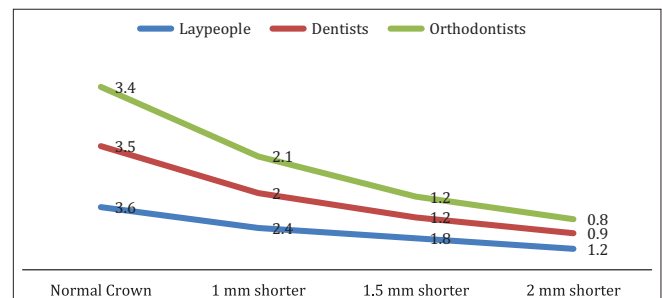


Figure 4: Mean smile rating of changes in central crown length

category were tested against the rest of the smiles to determine at which level the participants start rating the smile significantly less [Table 1].

Laypeople, dentists and orthodontists found the 0.5 mm reduced lateral crown width to be marginally better or as good as the average crown width [Figure 4]. Yet, for the dentists and orthodontists, the average crown width was rated significantly better than the 1 mm and 1.5 mm reduced crown width ( $P<0.01$ ). For laypeople, only the crown width of 1.5 mm reduction was found to be less esthetic ( $P<0.01$ ).

All three groups (laypeople, dentists and orthodontists) found the average crown length to be the most attractive (average means 3.6, 3.5, 3.4) [Figure 3]; the average crown length was rated significantly better than the rest of the photographs within each group ( $P<0.01$ ) [Table 1].

The more reduced the crown length, the least esthetic the smile was for all groups.

All three groups found the average smile to be the most esthetic, except when lateral crown width was considered; in this case, they rated the 0.5 mm reduced lateral width (laypeople, dentists and orthodontists average means are 3.6, 3.7 and 3.6, respectively) close to the average lateral width (laypeople, dentists and orthodontists average means are 3.7, 3.8 and 3.6, respectively). All three groups of participants agreed on their ratings of changes in incisal length, while laypeople were more tolerant regarding lateral incisor width.

## DISCUSSION

A patient's decision with regard to dental and orthodontic treatment is not driven by only the patient's wish; sometimes, it can be influenced by a general or specialized dentist's advice.

**Table 1: *P* values for testing the average smiles in each category against the rest of the smiles within the same category (underlined values are significant)**

Lateral incisor crown width			
Tested smiles ( <i>P</i> value)	Average width vs. 0.5 mm reduced width	Average width vs. 1 mm reduced width	Average width vs. 1.5 mm reduced width
Laypeople	0.3	0.4	<0.01
Dentists	0.04	<0.01	<0.01
Orthodontists	0.68	<0.01	<0.01
Central incisor crown length			
	Average vs. 1 mm shorter	Average vs. 1.5 mm shorter	Average vs. 2 mm shorter
Laypeople	<0.01	<0.01	<0.01
Dentists	<0.01	<0.01	<0.01
Orthodontists	<0.01	<0.01	<0.01

It has been shown previously in the literature that orthodontists and dentists are more sensitive than laypeople to a number of dental conditions.<sup>[7,8]</sup> Therefore, laypeople, dentists and orthodontists were asked to participate in this study.

In order to assess the contribution of each smile component to the overall smile, each component was tested independently. For this reason, two sets of photographs were developed, each set testing a smile feature. In this study, digitally manipulated photographs were used and each photograph represented a life-size smile with a digitally altered feature. This allowed the creation of a manipulated realistic image. Furthermore, this technique provided the flexibility to change only one feature of the smile while reasonably controlling the other features. This technique was adopted and used in previous reports.<sup>[9,10]</sup> Ideally, two sets of photographs should have been used, one for a male and another for a female individual. However, one gender photograph was used in order to reduce gender differences, especially skin tone, teeth color and lip shape. Although grey images were used to standardize the skin and teeth colors, lip shape was difficult to standardize<sup>[11]</sup> due to different lip shapes and tone between individuals.

The maxillary lateral incisor is the most common tooth that shows variation in its size, where it may be called diminutive, peg shaped lateral or, in some circumstances, it may fail to develop altogether.<sup>[12]</sup> Therefore, studying the incisors' proportion can be an ideal guide to suggest the appropriate tooth size for maximum esthetics. Currently, clinicians use one of the following methods to determine lateral incisor width: (1) Guidance from a normal-sized contralateral tooth,<sup>[13]</sup> (2) using the golden proportion with reference to adjacent teeth<sup>[7]</sup> and (3) using the average tooth proportions (e.g., the lateral incisor should be 50-74% of the central incisor).<sup>[6]</sup>

When lateral incisor width was considered in this paper, the laypeople, dentists and orthodontists found the average smile in addition to the 0.5 mm reduced lateral width to be almost equally esthetic. This was in contrast to any of the known and accepted suggestions of lateral incisor width (golden proportion, golden percentage or recurring esthetic dental proportion), with a lateral width that is 54% of the central width. Usually, participants would rate the average smile best as the lateral width was 61% of the central width, and this did follow the concept of golden proportion.<sup>[3]</sup> The fact that the golden proportion is not dominant within the population<sup>[14]</sup> could be the reason that the groups did not find the average smile significantly more esthetic than the 0.5 mm reduced width. Another reason would be that the produced ratio of 54% was truly favored by the all participants, which suggests that an esthetic laterals' width could fall within a range of 54-61% of the incisor width rather than suggesting a specific value. For laypeople, even a 1 mm reduction in lateral width was considered acceptable (48-61%). This further highlights the fact that both dentists and orthodontists are known to be more critical than laypeople.<sup>[15]</sup> Moreover, the lateral incisor

tooth proportion proved to be an important factor influencing smile esthetics, where smiles falling away from the suggested range (54-61%) were rated less esthetic.

With regard to the central incisor ratings, all three groups had no tolerance to 1 mm reduction to the central incisor length ( $P < 0.01$  when the average smile was compared with the rest). Interestingly, the average smile that has an incisor width to length ratio of 0.8:1 ratio was rated the most esthetic, which supports the ratio suggested by Sarver.<sup>[6]</sup> In the rest of the photographs within this category, as the incisor was shortened, two main features did change: The lateral length to width ratio and the smile arc. As the central incisors length is reduced, the smile arc appears flatter, and the flatter the smile arc the least esthetic it became.<sup>[16]</sup> This could explain why shorter incisors were rated less esthetic. However, it would be difficult to conclude which factor is more influential as both are interdependent. Still, whatever the theoretical explanation was, the fact that all three groups favored the average smile reflects the importance of the central incisor proportion and position as suggested in the literature.<sup>[6,17]</sup>

Conventional orthodontic mechanics can induce small changes in the smile arc and subsequently disturb its consonance.<sup>[18]</sup> Orthodontic extrusion and intrusion of central incisors can occur during the course of orthodontic treatment, and can affect the visible crown length.<sup>[16]</sup> This study reflects the lack of tolerance (of laypeople, dentists and orthodontists) to any changes of central crown length, which subsequently disturbs the central incisor crown proportion and the consonant smile arc. Moreover, it shows the importance of considering a range of lateral width rather than just using golden proportion or percentage, especially to predict the width of missing laterals in hypodontia cases.

## CONCLUSIONS

- Dentists and orthodontists favored a range of 54-61% regarding lateral to incisor width ratio, while laypeople favored a wider range of 48-61%.
- Laypeople, dentists and orthodontists did not accept any reduction in an average central incisor length.
- Changing the maxillary central incisor length, the maxillary lateral incisor width did influence the smiles esthetics.

## REFERENCES

1. McNamara L, McNamara JA, Jr, Ackerman MB, Baccetti T. Hard- and soft-tissue contributions to the esthetics of the posed smile in growing patients seeking orthodontic treatment. *Am J Orthod Dentofacial Orthop* 2008;133:491-9.
2. Ackerman MB, Ackerman JL. Smile analysis and design in the digital era. *J Clin Orthod* 2002;36:221-36.
3. Lombardi RE. The principles of visual perception and their clinical application to denture esthetics. *J Prosthet Dent* 1973;29:358-82.
4. Snow SR. Esthetic smile analysis of maxillary anterior tooth width: The golden percentage. *J Esthet Dent* 1999;11:177-84.
5. Ward DH. Proportional smile design using the recurring esthetic dental (red) proportion. *Dent Clin North Am* 2001;45:143-54.
6. Sarver DM. Principles of cosmetic dentistry in orthodontics: Part 1. Shape and proportionality of anterior teeth. *Am J Orthod Dentofacial Orthop* 2004;126:749-53.
7. Kokich VO Jr, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent* 1999;11:311-24.
8. Johnston CD, Burden DJ, Stevenson MR. The influence of dental to facial midline discrepancies on dental attractiveness ratings. *Eur J Orthod* 1999;21:517-22.
9. Martin AJ, Buschang PH, Boley JC, Taylor RW, McKinney TW. The impact of buccal corridors on smile attractiveness. *Eur J Orthod* 2007;29:530-7.
10. Parekh S, Fields HW, Beck FM, Rosenstiel SF. The acceptability of variations in smile arc and buccal corridor space. *Orthod Craniofac Res* 2007;10:15-21.
11. Flores-Mir C, Silva E, Barriga MI, Lagravere MO, Major PW. Lay person's perception of smile aesthetics in dental and facial views. *J Orthod* 2004;31:204-9.
12. Afify AR, Zawawi KH. The prevalence of dental anomalies in the Western region of Saudi Arabia. *ISRN Dent* 2012;2012:837270.
13. Kokich V. Esthetics and anterior tooth position: An orthodontic perspective. Part III: Mediolateral relationships. *J Esthet Dent* 1993;5:200-7.
14. Gillen RJ, Schwartz RS, Hilton TJ, Evans DB. An analysis of selected normative tooth proportions. *Int J Prosthodont* 1994;7:410-7.
15. Batwa W, Hunt NP, Petrie A, Gill D. Effect of occlusal plane on smile attractiveness. *Angle Orthod* 2012;82:218-23.
16. Sarver DM. The importance of incisor positioning in the esthetic smile: The smile arc. *Am J Orthod Dentofacial Orthop* 2001;120:98-111.
17. Duarte S Jr, Schnider P, Lorezon AP. The importance of width/length ratios of maxillary anterior permanent teeth in esthetic rehabilitation. *Eur J Esthet Dent* 2008;3:224-34.
18. Ackerman JL, Ackerman MB, Brensinger CM, Landis JR. A morphometric analysis of the posed smile. *Clin Orthod Res* 1998;1:2-11.

**How to cite this article:** Alsulaimani FF, Batwa W. Incisors' proportions in smile esthetics. *J Orthodont Sci* 2013;2:109-12.

**Source of Support:** Nil, **Conflict of Interest:** None declared.

## Staying in touch with the journal

### 1) Table of Contents (TOC) email alert

Receive an email alert containing the TOC when a new complete issue of the journal is made available online. To register for TOC alerts go to [www.jorthodsci.org/signup.asp](http://www.jorthodsci.org/signup.asp).

### 2) RSS feeds

Really Simple Syndication (RSS) helps you to get alerts on new publication right on your desktop without going to the journal's website. You need a software (e.g. RSSReader, Feed Demon, FeedReader, My Yahoo!, NewsGator and NewzCrawler) to get advantage of this tool. RSS feeds can also be read through FireFox or Microsoft Outlook 2007. Once any of these small (and mostly free) software is installed, add [www.jorthodsci.org/rssfeed.asp](http://www.jorthodsci.org/rssfeed.asp) as one of the feeds.